

S1 8410937 S NERVE? ? OR NEURAL? OR NEURO OR NEURON? OR NEUROM? OR NEUROL? OR NEUROP?

S2 5361936 S INNERVAT? OR MYOELECTRIC? OR SPINAL()CORD? ? OR CENTRAL()NERVOUS OR CNS OR BRAIN OR (DORSAL OR VENTRAL OR POSTERIOR OR ANTERIOR)()ROOT? ? OR AXON?? OR GANGLION?

S3 78655 S PEDICLE? ? OR VERTEBRAL()BODY OR TRANSVERSE()PROCESS??

S4 1886716 S1:S2 (20N)( IMPULSE? ? OR ACTIVIT??? OR SIGNAL? ? OR SHOCK??? OR STIM? OR ELECTROSTIMULAT? OR ELECTROSHOCK? OR CURRENT? ? OR ELECTRIC??? OR ELECTROPHYSIOLOG?) FROM 155, 5, 73, 74, 2, 6, 8, 35, 65, 99, 91, 164, 467, 144, 23, 34, 434, 9, 16, 160, 148, 621, 347, 35

S5 1755948 S S1:S2 (20N)(MORPHOLOG??? OR LOCATION OR PROXIMIT? OR MAP? ? OR MAPP??? OR DISPLAY? ? OR INDICAT??? OR POSITION? OR DIRECTION? ? OR DETECT? OR DETERMIN? OR ASCERTAIN? OR IDENTIF? OR ASSESS?)

S6 397285 S S4(50N)S5

S7 5273913 S INTEGRITY OR WHOLE OR UNDIVIDED OR INTEGRAL OR UNIMPAIRED OR UNCORRUPTED OR UNDETERIORATED OR UNWEAKENED OR UNDAMAGED OR "NOT" (3W)(DETERIORATED OR WEAKENED OR DAMAGED OR IMPAIRED OR CORRUPTED)

S8 941 S S3(20N)S7

S9 20 S S6(60N)S8

S10 8 RD S9 (unique items)

S11 37 S S4(60N)S8

S12 17 S S11 NOT S9

S13 0 S S12/2003:2008

S14 6 RD S12 (unique items)

S15 58 S S5(60N)S8

S16 38 S S15 NOT(S11 OR S9)

S17 8 S S16/2003:2008

S18 30 S S16 NOT S17

S19 13 RD S18 (unique items)

S20 342928 S S4(10N)S5

S21 30370 S S4(10N)THRESHOLD?

S22 8 S S20(50N)S10

S23 0 S S22 NOT(S11 OR S9 OR S15)

; show files

[File 155] MEDLINE(R) 1950-2008/May 30

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[File 347] JAPIO Dec 1976-2007/Dec(Updated 080328)

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[File 350] Derwent WPIX 1963-2008/UD=200834

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10/8,K/1 (Item 1 from file: 155)

MEDLINE(R)

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14006101 PMID: 11249183

Spinal cord and nerve root monitoring during surgical treatment of lumbar stenosis.

Mar 2001

Descriptors: \*Lumbar Vertebrae--surgery--SU; \*Monitoring, Intraoperative; \*Spinal Cord --physiology--PH;

\*Spinal Nerve Roots--physiology--PH; \*Spinal Stenosis --surgery--SU ; Decompression, Surgical;

Electromyography--methods--MT; Evoked Potentials, Motor; Evoked Potentials, Somatosensory; Humans;

Monitoring, Intraoperative --methods--MT

...of spinal deformity are well known and documented. Free-running and evoked electromyographic studies during pedicle screw implantation is an accepted practice at many institutions. However, the functional integrity of spinal cord, cauda equina, and nerve roots should be monitored throughout every stage of surgery including exposure and decompression. Somatosensory evoked potentials monitor overall spinal cord function. Intraoperative electromyography provides continuous assessment of motor root function in response to direct and indirect surgical manipulation. Electromyographic activities observed during exposure and decompression of the lumbosacral spine included complex patterns of bursting and... (

10/8,K/2 (Item 2 from file: 155)

MEDLINE(R)

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13538659 PMID: 10752102

Electrical thresholds for biomechanical response in the ankle to direct stimulation of spinal roots L4, L5, and S1. Implications for intraoperative pedicle screw testing.

Mar 15 2000

Descriptors: \*Ankle--physiology--PH; \*Electric Stimulation--instrumentation--IS; \*Nerve Compression

Syndromes--surgery--SU; \*Neural Conduction; \*Spinal Nerve Roots ; Biomechanics; Bone Screws; Electric

Stimulation--methods--MT; Electromyography; Humans; Intervertebral Disk Displacement--complications --CO; Nerve Compression Syndromes--etiology--ET; Reflex--physiology--PH; Sensitivity and Specificity; Signal Processing, Computer-Assisted; Torque

...biomechanical responses were significantly lower than for CMAP responses ( $P = 0.0004$ ; paired  $t$  test). Nerve roots were electrically most excitable on their ventral aspects. CONCLUSION: The biomechanical response in the joint to root stimulation can be used to test all root-related muscles crossing that joint at their individual innervation pattern and their residual innervation and to detect electrical excitation of the root at electric thresholds lower than those for detecting CMAP from single standard root-specific muscle. However, this method does not provide sufficient root specificity. It will be valuable in conjunction with multimodality neurophysiologic monitoring of the roots for earlier and more reliable detection of pedicle bone breakthrough or integrity. Further clinical investigations are suggested. (

10/8,K/3 (Item 3 from file: 155)

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12580140 PMID: 9474730

Higher electrical stimulus intensities are required to activate chronically compressed nerve roots. Implications for intraoperative electromyographic pedicle screw testing.

Jan 15 1998

Descriptors: \*Electric Stimulation Therapy--methods--MT; \*Nerve Compression Syndromes --therapy--TH; \*Spinal Nerve Roots ; Action Potentials--physiology--PH; Aged; Bone Screws; Chronic Disease; Electromyography; Humans; Intraoperative Period; Middle Aged; Muscles --physiopathology--PP; Nerve Compression Syndromes--physiopathology--PP; Peripheral Nervous System Diseases--therapy--TH

STUDY DESIGN: A comparison of the electrical thresholds required to evoke myogenic responses from direct stimulation of normal and chronically compressed nerve roots. OBJECTIVE: To determine whether intraoperative electromyographic testing to confirm the integrity of instrumented pedicles should be performed at higher stimulus intensities in cases where there is preoperative lumbosacral radiculopathy. SUMMARY OF BACKGROUND DATA: Postoperative neurologic deficits may occur as a result of pedicle screw misplacement during spinal instrumentation. The failure to evoke myogenic responses from stimulation of pedicle holes and screws at intensities of 6-8 mA is commonly used to... (

10/8,K/4 (Item 4 from file: 155)

MEDLINE(R)

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08755069 PMID: 3185303

Vascular isolation of the rat cremaster muscle.

Jul 1988

Tags: Male

Descriptors: \*Microcirculation; \*Muscles--blood supply--BS ; Acetylcholine--pharmacology--PD; Animals; Arterioles--drug effects--DE; Blood Flow Velocity; Microcirculation--drug effects--DE; Models, Biological ;

Muscles--drug effects--DE; Norepinephrine--pharmacology--PD; Perfusion; Rats; Rats, Inbred Strains;  
Vasoconstriction--drug effects--DE

CAS Registry No.: 51-41-2 (Norepinephrine); 51-84-3 (Acetylcholine)

...cremaster vascular supply and the surgical approach to isolate the cremaster muscle on its neurovascular pedicle are described. The functional integrity of this isolated cremaster preparation was tested using intravital video microscopy to evaluate the tissue's response to vasoactive agents and to peripheral nerve stimulation. The isolated cremaster muscle was positioned in situ in a controlled tissue bath and concentration response curves to the topical application of norepinephrine (NE) and acetylcholine (Ach) were determined. Vasoconstriction elicited by the topical application of NE or by stimulation of the genitofemoral nerve trunk was similar for both the isolated and standard cremaster preparations. Application of  $10(-5 \dots$  (

10/8,K/7 (Item 3 from file: 350)

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Derwent WPIX

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0013813339 & & *Drawing available*

WPI Acc no: 2003-382307/200336

Related WPI Acc No: 2003-184257; 2003-333261; 2004-593291

XRPX Acc No: N2003-305430

Title Terms /Index Terms/Additional Words: PERCUTANEOUS; INTEGRITY; ASSESS; SYSTEM; NEURO; PHYSIOLOGICAL; APPLY; STIMULATING; SIGNAL; MONITOR; ADJACENT; NERVE

Class Codes

International Patent Classification

IPC	Class Level	Scope	Position	Status	Version Date			
A61B; A61B-017/56			Main		"Version 7"			
A61B-0017/16	A	N		R	20060101			
A61B-0017/17	A	N		R	20060101			
A61B-0017/56	A	I	F	R	20060101			
A61B-0017/88	A	I		R	20060101			
A61B-0005/04	A	I	L	B	20060101			
A61B-0005/0488	A	I		R	20060101			
A61B-0005/05	A	I		R	20060101			
A61B-0005/05	A	N		R	20060101			
A61B-0005/11	A	I		R	20060101			
A61N-0001/05	A	I	F	B	20060101			
A61N-0001/05	A	I		R	20060101			
A61N-0001/08	A	I		R	20060101			
A61N-0001/34	A	N		R	20060101			
A61B-0017/16	C	N		R	20060101			

A61B-0017/56	C	I	F	R	20060101		
A61B-0017/88	C	I		R	20060101		
A61B-0005/04	C	I	L	B	20060101		
A61B-0005/0488	C	I		R	20060101		
A61B-0005/05	C	I		R	20060101		
A61B-0005/05	C	N		R	20060101		
A61B-0005/11	C	I		R	20060101		
A61N-0001/05	C	I	L	B	20060101		
A61N-0001/05	C	I		R	20060101		
A61N-0001/08	C	I		R	20060101		
A61N-0001/32	C	N		R	20060101		

US Classification, Issued: 60748, 60699

File Segment: EngPI; EPI;

DWPI Class: S05; P31; P34

Manual Codes (EPI/S-X): S05-B03; S05-B09; S05-D01A2

Percutaneous pedicle integrity assessment system in neuro-physiology by applying stimulation signal and monitoring if adjacent nerves are enervated Original Publication Data by AuthorityArgentinaPublication No. Claims:What is claimed is:1. A method for performing percutaneous pedicle integrity assessments, comprising the steps of:(a) percutaneously introducing an insulation member to a pedicle target site;(b) establishing electrical communication between a stimulation element and an interior of a pedicle screw pilot hole;(c) applying a stimulation signal to said stimulation element; and(d) monitoring to assess whether nerves adjacent said pedicle are innervating as a result of the step of applying said application of stimulation signal to said stimulation element...

10/8,K/8 (Item 4 from file: 350)

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0013811917 & & *Drawing available*

WPI Acc no: 2003-333261/200331

Related WPI Acc No: 2003-184257; 2003-382307; 2004-593291

XRPX Acc No: N2003-267077

Title Terms /Index Terms/Additional Words: SYSTEM; PERFORMANCE; SURGICAL; PROCEDURE; ASSESS; ACCESSORY; STIMULATING; ELECTRODE; PROCESS; DETERMINE; NERVE; PROXIMITY; DIRECTION; INTEGRITY; NEURAL; PATHOLOGICAL

Class Codes

# International Patent Classification

IPC	Class Level	Scope	Position	Status	Version Date			
A61B			Main		"Version 7"			
A61B-0001/00	A	I		R	20060101			
A61B-0017/34	A	I		R	20060101			
A61B-0019/00	A	N		R	20060101			
A61B-0005/04	A	I		R	20060101			
A61B-0005/0488	A	I	F	R	20060101			
A61B-0005/0492	A	I		R	20060101			
A61B	S	I		R	20060101			
A61B-0001/00	C	I		R	20060101			
A61B-0017/34	C	I		R	20060101			
A61B-0019/00	C	N		R	20060101			
A61B-0005/04	C	I		R	20060101			
A61B-0005/0488	C	I	F	R	20060101			

US Classification, Issued: 600554, 600546

File Segment: EngPI; EPI;

DWPI Class: S05; T01; P31

Manual Codes (EPI/S-X): S05-B04; S05-D01A2; T01-J06A

System for performing surgical procedures and assessments has surgical accessory with stimulation electrode and processing system to determine nerve proximity, nerve direction, pedicle integrity and neural pathology Alerting Abstract ...least one stimulation electrode. Processing system has computer programming software, firmware and hardware capable of stimulating stimulation electrode on surgical accessory. System measures response of nerves depolarized by stimulation. Relationship is determined between surgical accessory and nerve based on measured response. Relationship is communicated to user and is used to determine at least one of nerve proximity, nerve direction, pedicle integrity and neural pathology. Original Publication Data by AuthorityArgentinaPublication No. ...Claims:processing system having at least one of computer programming software, firmware and hardware capable of stimulating said at least one stimulation electrode on a surgical accessory, measuring the response of nerves depolarized by said stimulation, determining a relationship between the surgical accessory and the nerve based upon the response measured, and communicating said relationship to a user, wherein said relationship may be used to determine at least one of nerve proximity, nerve direction, pedicle integrity, and neural pathology.

14/5/1 (Item 1 from file: 155)

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14719303 PMID: 12131744

Neurophysiologic monitoring of spinal nerve root function during instrumented posterior lumbar spine surgery.

Bose Bikash; Wierzbowski Lawrence R; Sestokas Anthony K

Department of Neurosurgery, Christiana Care Health System, Newark, Delaware, USA.

Spine ( United States ) Jul 1 2002 , 27 (13) p1444-50 , ISSN: 1528-1159--Electronic Journal Code: 7610646

Publishing Model Print

Document type: Journal Article

Languages: ENGLISH

Main Citation Owner: NLM

Record type: MEDLINE; Completed

Subfile: INDEX MEDICUS

**STUDY DESIGN:** Retrospective review of 61 consecutive patients. **OBJECTIVES:** To determine the effectiveness of combining intraoperative monitoring of both spontaneous electromyographic activity and compound muscle action potential response to stimulation for detecting a perforation of the pedicle cortex irritation of nerve root during lumbar spine fusion surgery. **SUMMARY OF BACKGROUND DATA:** The complication rate from instrumentation used with lumbar spine fusion varies from 1 to 33%. To prevent neurologic complications, several monitoring techniques have been used to alert surgeons to possible neurologic damage being introduced during nerve decompression or placement of instrumentation with spine procedures. Because of different sensitivities, one monitoring technique may not be as effective for preventing complications as a combination of techniques. **METHODS:** Sixty-one consecutive patients who underwent instrumented posterior lumbar fusions received continuous electromyographic monitoring and stimulus-evoked electromyographic monitoring. A significant neurophysiologic event was signaled by sustained neurotonic electromyographic activity, prompting an alert and a pause in the surgical manipulations that precipitated the activity. After insertion of the transpedicular screws, the integrity of the pedicle cortex was tested by stimulating each screw head and recording compound muscle action potentials. In the presence of a pedicle breach, stimulus intensities below 7 mA were sufficient to evoke compound muscle action potentials from the muscle group innervated by the adjacent spinal nerve root, prompting a surgical alert and subsequent repositioning of the screw. **RESULTS:** Fourteen significant neurophysiologic events occurred in 13 of 61 patients (21%). Sustained neurotonic electromyographic discharges occurred in 5 of 40 patients during placement of interbody fusion cages, in 2 patients during placement of transpedicular screws, and in 1 patient during tightening of rods. On pedicle screw stimulation, breaches of the pedicle cortex were detected in 6 patients. After surgery, no new neurologic deficits were found in 60 of the 61 patients. One patient who experienced temporary paraparesis had sustained neurotonic electromyographic discharges during retraction of the thecal sac and distraction of the disc space before placement of the cage. **CONCLUSION:** These results suggest that intraoperative electromyographic monitoring provides a real-time measure of impending spinal nerve root injury during instrumented posterior lumbar fusion, allowing for timely intervention and minimization of negative postoperative sequela.

**Descriptors:** \*Intraoperative Complications--prevention and control--PC; \*Monitoring, Intraoperative--methods--MT; \*Postoperative Complications--prevention and control--PC; \*Spinal Fusion; \*Spinal Nerve Roots--physiology--PH; Action Potentials--physiology--PH; Adult; Aged; Aged, 80 and over; Bone Screws--adverse effects--AE; Electric Stimulation; Electromyography; Humans; Lumbosacral Region; Middle Aged; Predictive Value of Tests; Retrospective Studies; Spinal Fusion--adverse effects--AE; Spine--surgery--SU

Record Date Created: 20020719

Record Date Completed: 20020926

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MEDLINE(R)

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12154234 PMID: 9051896

Persistently electrified pedicle stimulation instruments in spinal instrumentation. Technique and protocol development.

Rose R D; Welch W C; Balzer J R; Jacobs G B

Department of Neurological Surgery, University of Pittsburgh Medical Center, Pennsylvania, USA.

Spine ( UNITED STATES ) Feb 1 1997 , 22 (3) p334-43 , ISSN: 0362-2436--Print Journal Code: 7610646

Publishing Model Print

Document type: Journal Article

Languages: ENGLISH

Main Citation Owner: NLM

Record type: MEDLINE; Completed

Subfile: INDEX MEDICUS

**STUDY DESIGN:** A prospective review was done of a new intraoperative technique developed to detect and prevent neurologic compromise during pedicle screw insertion. **OBJECTIVES:** To describe in sufficient detail the technique of persistently electrified pedicle stimulation instruments, so that this technique will be available generally to all clinical neurophysiologists and spine surgeons; and to demonstrate the use, typical results, interpretation, and protocol of the technique. **SUMMARY AND BACKGROUND DATA:** Fusion techniques that use pedicle instrumentation have the potential to cause nerve root injury. Several authors have proposed imaging and neurophysiologic methods to improve outcome. The present method represents a significant theoretical departure and advance from previously reported methods. **METHODS:** All relevant instruments used during pedicle instrumentation were converted easily, inexpensively, and quickly into monopolar stimulators with appropriate stimulus voltages to identify broaches of pedicle bone via evoked-electromyograms from relevant muscle groups. **RESULTS:** The persistently electrified pedicle stimulation instrument technique provided accurate intraoperative neurophysiologic information concerning pedicle, integrity in the patients studied. The protocol is standardized and adaptable easily, inexpensively, and quickly to most clinical applications. **CONCLUSIONS:** The persistently electrified pedicle stimulation instrument technique described here is useful for monitoring instrumented lumbar fusion procedures. The use of this protocol may help confirm intraosseous placement of pedicle screws and prevent neurologic injury.

**Descriptors:** \*Bone Screws; \*Electromyography--instrumentation--IS; \*Spinal Fusion ; Electric Stimulation; Electromyography--methods--MT; Evaluation Studies as Topic; Evoked Potentials, Somatosensory; False Negative Reactions; False Positive Reactions; Humans; Intraoperative Period; Prospective Studies; Spinal Fractures--surgery--SU

Record Date Created: 19970515

Record Date Completed: 19970515

14/5/5 (Item 1 from file: 2)

INSPEC

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06869671 INSPEC Abstract Number: A9809-8770F-013, B9805-7510D-018

Title: System for intra-operative monitoring of the cortical integrity of the pedicle during pedicle screw placement in low-back surgery: design and clinical results

Author Journee, H.L.; Pavlov, P.W.; Polak, B.; de Bruin, S.

Author Affiliation: JS Centre, Bedum, Netherlands

Conference Title: Proceedings of the 18th Annual International Conference of the IEEE Engineering in Medicine and Biology Society. 'Bridging Disciplines for Biomedicine' (Cat. No.96CH36036) Part vol.1 p. 144-5 vol.1

Editor(s): Boom, H.; Robinson, C.; Rutten, W.; Neuman, M.; Wijkstra, H.

Publisher: IEEE, New York, NY, USA

Publication Date: 1997 Country of Publication: USA 5 vol. xxxiv+2315 pp.

ISBN: 0 7803 3811 1 Material Identity Number: XX97-01512

U.S. Copyright Clearance Center Code: 0 7803 3811 1/97/\$10.00

Conference Title: Proceedings of 18th Annual International Conference of the IEEE Engineering in Medicine and Biology Society

Conference Sponsor: Int. Federation of Med. & Biol. Eng.; Eur. Soc. Eng. & Med

Conference Date: 31 Oct.-3 Nov. 1996 Conference Location: Amsterdam, Netherlands

Language: English Document Type: Conference Paper (PA)

Treatment: Practical (P); Experimental (X)

Abstract: The placement of pedicle screws may involve a damage to the pedicle wall as well as to the adjacent nerve roots. This is visible as a lowering of the trans-screw stimulation current threshold of evoked compound action potentials (CAP) of the leg muscles and as a decrease of the electrical impedance of the screw. The objective was to design a system for intra-operative monitoring of the integrity of the pedicle wall and motor nerve and to test it in clinical practice. Spontaneous EMGs and CAPs, evoked by electrostimulation of the nerve and via the screw, of 8 muscle groups in the leg were recorded and furthermore, the screw impedance was measured. 102 pedicle screws were monitored. It is concluded that during pedicle screw fixation, the current thresholds for CAPs and impedance measurements are useful for monitoring nerve root integrity. Impedance measurements provide an early warning of the cortex of the pedicle by screw placement. ( 2 Refs)

Subfile: A B

Descriptors: biomedical measurement; electric impedance measurement; electromyography; neurophysiology; patient monitoring; surgery

Identifiers: low-back surgery; pedicle screw placement; cortical integrity of pedicle; intra-operative monitoring system; clinical results; trans-screw stimulation current threshold; evoked compound action potentials; leg muscles; electrical impedance decrease; pedicle wall; motor nerve; spontaneous EMG; electrostimulation; current thresholds; motor evoked potentials

Class Codes: A8770F (Electrodiagnostics); A8770G (Patient care and treatment); A8730C (Electrical activity in neurophysiological processes); B7510D (Bioelectric signals); B7520 (Patient care and treatment); B7310J (Impedance and admittance measurement)

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19/5/3 (Item 3 from file: 155)

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12353768 PMID: 9285605

Evaluation with evoked and spontaneous electromyography during lumbar instrumentation: a prospective study.

Welch W C; Rose R D; Balzer J R; Jacobs G B

Department of Neurological Surgery, School of Rehabilitative Sciences and Center for Clinical Neurophysiology, University of Pittsburgh Medical Center, Pennsylvania, USA.

Journal of neurosurgery ( UNITED STATES ) Sep 1997 , 87 (3) p397-402 , ISSN: 0022-3085--Print Journal Code: 0253357

Publishing Model Print

Document type: Journal Article

Languages: ENGLISH

Main Citation Owner: NLM

Record type: MEDLINE; Completed

Subfile: AIM; INDEX MEDICUS

The neuroanatomical structures that approximate the bony pedicles of the lumbar spine allow little room for technical error or compromise of the bone during pedicle screw insertion. Currently available neurophysiological monitoring techniques detect compromised bone and nerve root injury after it occurs. The purpose of this prospective study is to evaluate the reliability and efficacy of a unique neurophysiological monitoring technique. This technique provides immediate evaluation of pedicle cortical bone integrity in patients undergoing lumbar fusion with instrumentation by using electrified surgical instruments throughout the pedicle screw fusion procedure. Spontaneous electromyographic (EMG) activity was also monitored. Intraoperative evoked EMG stimulation was performed using a pedicle probe and feeler as monopolar stimulators during the insertion of 164 pedicle bone screws in 32 patients. The EMG response to subthreshold stimulation intensities indicated cortical bone compromise. Immediate and conclusive feedback via evoked EMG activity using stimulating pedicle probes in appropriate muscle groups was successful in identifying pedicle cortical bone compromise in four patients. One false-negative evoked EMG study was noted but was identified via spontaneous EMG activity. Intraoperative EMG monitoring alerted the surgeon that redirection of the pedicle probe or screw was necessary to avoid nerve root irritation or injury and served as an early warning system. Evoked EMG stimulation proved to be reliable and efficacious, especially when used in combination with spontaneous EMG. This technique may provide an added safeguard during implant placement procedures at centers where intraoperative neurophysiological monitoring is routinely performed.

Tags: Female; Male

Descriptors: \*Bone Screws--adverse effects--AE; \*Electromyography--instrumentation--IS; \*Evoked Potentials, Motor; \*Evoked Potentials, Somatosensory; \*Spinal Fusion--instrumentation--IS; \*Spinal Nerve Roots--injuries--IN; \*Spinal Nerve Roots--physiopathology--PP ; Adult; Aged; Electromyography--methods--MT; Humans; Middle Aged; Monitoring, Intraoperative--methods--MT; Peripheral Nervous System Diseases --etiology--ET; Peripheral Nervous System Diseases--physiopathology--PP; Peripheral Nervous System Diseases--prevention and control--PC; Prospective Studies; Reproducibility of Results; Spinal Fusion--adverse effects--AE

Record Date Created: 19970916

Record Date Completed: 19970916

19/5/8 (Item 1 from file: 5)

Biosis Previews(R)

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17130845 Biosis No.: 200300089564

Electromyographic Detection of Malpositioned Pedicle Screws during Spinal Fusion.

Author: Cronin A J (Reprint); Gelb D E (Reprint); Forjan A (Reprint); Russell G B (Reprint)

Author Address: Anesthesiology, Penn State College of Medicine, Hershey, PA, USA\*\*USA

Journal: Anesthesiology Abstracts of Scientific Papers Annual Meeting ( 2000 ): p Abstract No. 270  
2002 2002

Medium: cd-rom

Conference/Meeting: 2000 Annual Meeting of the American Society of Anesthesiologists San Francisco, CA, USA October 16-18, 2000; 20001016

Sponsor: American Society of Anesthesiologists Inc.

Document Type: Meeting; Meeting Abstract

Record Type: Abstract

Language: English

**Abstract:** Instrumental fixation of vertebral segments during posterior spinal fusion (PSF) requires insertion of screws into the spinal pedicle, usually of lumbar (L) or sacral (S) vertebral, but sometimes at thoracic (T) levels as well. Incorrectly positioned screws which breach the bony pedicle wall can result in acute nerve root injury or sub-acute injury with neural inflammation. This results in neurological deficits and chronic pain syndromes. Triggered electromyography (EMG) is often used to detect breaches of vertebral pedicle integrity intraoperatively. We hypothesized that: (1) EMG monitoring would result in a decreasing incidence of malpositioned pedicle screws over time by altering surgical technique in response to recurrent intraoperative EMG feedback on screw position; and (2) screws placed in the first lumbar pedicles would have the highest incidence of malposition. **METHODS:** 233 patients undergoing posterior spinal fusion were monitored with triggered EMG over a period of 48 months. EMG compound muscle action potentials were recorded from the anterior tibialis, gastrocnemius, and quadriceps muscles bilaterally after gradually increasing levels of electrical stimulation (Viking IV, Nicolet, Inc., Madison, WI) of each screw. The stimulus threshold level at which EMG firing occurred was recorded. A threshold of <6 milliamperes (with constant current stimulation) or <20 volts (with constant voltage stimulation) was considered positive for a breached bony cortex. A positive test resulted in the screw being surgically repositioned. **RESULTS:** Data from all patients studied (108 males; mean age, 45.4 years; 616 screws inserted; and 125 females; mean age 49.4 years; 696 screws inserted) were included in analysis. Pedicle screws were most commonly inserted into spinal pedicles at levels L4>S1>L5>L3>L2>L1>S2>T12. Only 6.3% of screws placed (83 of 1312) tested positive (screws were defined as malpositioned). The incidence of positive screws did vary, but the rate did not decrease over time (rates of 8.9%, 5.2%, 7.4%, and 6.9% for each of four consecutive years). A wide variation in positive rates was noted between surgeons. Screws inserted into the S1 pedicle consistently had a higher incidence of malposition bilaterally (10% - left; 10.8% - right). The incidence of positive screws is often higher unilaterally at a single level. For example, at L5 right pedicle had only 0.08% of screws positive (1 of 130), but 6.5% positive (8 of 123) on the left. Only one patient exhibited postoperative signs of a pedicle screw injury. **CONCLUSIONS:** While triggered EMG is a reliable monitor of bony cortex disruption and possible injury during pedicle screw insertion during PSF, this feedback did not result in improved accuracy of surgical placement over four years. High sacral screws had the highest incidence of malposition.

#### DESCRIPTORS:

Major Concepts: Equipment Apparatus Devices and Instruments; Methods and Techniques; Neurology--Human Medicine, Medical Sciences; Orthopedics--Human Medicine, Medical Sciences

Biosystematic Names: Hominidae--Primates, Mammalia, Vertebrata, Chordata, Animalia

Organisms: human (Hominidae)--patient

Organisms: Parts Etc: anterior tibialis--muscular system; gastrocnemius--muscular system; quadriceps--muscular system

Common Taxonomic Terms: Animals; Chordates; Humans; Mammals; Primates; Vertebrates

Diseases: neurological deficits--nervous system disease; acute nerve root injury-- injury, nervous system disease

Methods & Equipment: electromyography--clinical techniques, diagnostic techniques; spinal pedicle screw--medical equipment; spinal fusion--clinical techniques, therapeutic and prophylactic techniques

Miscellaneous Terms: Concept Codes: malpositioned pedicle screws; Meeting Abstract

Concept Codes:

00520 General biology - Symposia, transactions and proceedings

17504 Muscle - Physiology and biochemistry

18006 Bones, joints, fasciae, connective and adipose tissue - Pathology

20506 Nervous system - Pathology

Biosystematic Codes:

86215 Hominidae